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Further Investigation of the Factor Structure of the Five Factor Model of Personality: A Search for Moderator Variables

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FURTHER INVESTIGATION OF THE FACTOR STRUCTURE OF THE FIVE FACTOR MODEL OF PERSONALITY: A SEARCH FOR MODERATOR VARIABLES

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Abstract

Although somewhat controversial, the Five Factor Model (FFM) of personality has remained prominent in normal personality research. Previous studies involving the FFM of personality have failed to examine individual differences that could moderate the number of factors in the FFM. This study investigated two such individual difference variables: need for cognition and working memory. Instruments measuring the FFM, need for cognition and working memory were administered to a sample of undergraduate students. Multigroup confirmatory factor analysis indicated the hypothesized model fit equally well across high and low scoring subgroups of both need for cognition and working memory.

Introduction and Review of the Literature

The Five Factor Model (FFM) (or Big Five) model of personality has been a prominent topic of study in both personnel and personality psychology. The factors of the FFM have been commonly identified as surgency (extraversion), agreeableness, dependability (conscientiousness), emotional stability (neuroticism) and culture (openness to experience). Many researchers have embraced the FFM, praising its comprehensiveness and theoretical completeness (Digman, 1981; Goldberg, 1993; Peabody, 1987; Tupes & Christal, 1961). Other researchers have taken the side of skepticism (Block, 1995; Cattell, 1943; Eysenck, 1992; Norman, 1963). Of the many reasons they cite for not endorsing the FFM, one of the most notable arguments relates to the number of factors. These critics believe that it is impossible to describe the entire domain of normal personality using only five factors (Cattell, 1943; Eysenck, 1992; Peabody & Goldberg, 1989). In spite of the apparent overly simplistic nature of the model, empirical studies have repeatedly found support for the same five factors. This study seeks to determine whether the number of factors in the FFM is a function of individual differences in intelligence, specifically in working memory and Need for Cognition (NFC).

The Five Factor Model of Personality

The concept of the FFM of personality began with the work of Allport and Odbert (1936). These researchers attempted to find a comprehensive list of all traits that could be used to describe the normal personality, defined as nonclinical aspects of personality for which there is variance across a group of people. They proposed the lexical hypothesis, which states that all aspects of the human personality that are considered important,

interesting, or valuable have been recorded in language. Their efforts resulted in a list of 18,000 terms. Cattell (1943) expanded and further defined the lexical hypothesis with his concept of the trait sphere. The trait sphere is defined as "the universe of all traits, ideally covering all aspects of personality, or at least sampling them with even density…" (Cattell, p. 482). Traits that describe enduring aspects of personality have remained relatively unchanged in the past three hundred years. Furthermore, any additions to the trait sphere are social or cultural in nature (Cattell). The trait sphere is a universal concept because most traits are represented in all languages. Any traits that cannot be translated into other languages are considered to be culture-specific. Cattell began with 171 traits, and condensed the traits into a list of 60 variable clusters by means of factor analysis. These clusters were then used as a basis for future research to determine which clusters could be grouped together to measure personality.

Early Examinations of the Number of Factors

Empirical research on these trait clusters began in the 1940s with Cattell (1947). His research used a set of 35 bipolar variables, each with a set of descriptive adjectives. After completing a factor analysis on data collected using these 35 variables, he found evidence for 12 factors; he named these variables the "personality sphere" (Cattell, p. 198). Cattell used these findings to develop the Sixteen Personality Factor Questionnaire (16PF; Cattell & Cattell, 1995). Krug and Johns (1986) cross-validated the second-order factor structure of the 16PF on a large sample of males and females. The results of the study indicated that the analysis of the second-order factor structure provided support for the FFM, and that the five factors captured the majority of the variance in the primary scales of the 16PF.

Tupes and Christal (1961) also examined the five factor structure using peer-nominations. The peer-nomination strategy involves asking the participants to think of some person (target individual) other than themselves, and make ratings based on that individual. The participants made ratings using traits from Cattell's instrument. The researchers found that across eight different samples, five factors consistently emerged. Norman (1963) used Cattell's variables in an attempt to find more than five factors. Norman was convinced that the technical and computational limitations of the 1930s and 1940s limited the number of factors to five. He was not successful in his attempts to isolate more than five factors (Goldberg, 1993) but was able to replicate the factor structure found by Tupes and Christal. Even when participants had limited contact with the target individual, five factors were still identified from their ratings.

Passini and Norman (1966) attempted to replicate the findings relating to limited contact between raters and ratees, and found support for the FFM personality structure. The factor structure was identified regardless of whether the participants had extensive prior knowledge of the individual they were rating. Digman and Takemoto-Chock (1981) analyzed six different studies and found that, regardless of the type of relationship that existed between the raters and the ratees, the results were the same and the FFM factor structure was supported and replicated. Digman (1981) found support for a 10 factor model of child personality, and believed there were more factors for the adult personality. However, when he attempted to rotate the 10 factors from other researchers' data, he could not find support for any more than five factors. Finally, McCrae and Costa (1987) found support for the FFM using multiple instruments and multiple rating sources.

Empirical Support Using Other Marker Variables

The research mentioned previously (Digman & Takemoto-Chock, 1981; Norman, 1963; Passini & Norman, 1966; Tupes & Christal, 1961) was based on Cattell's original 35 variables. Although the repeated support for the FFM found by the aforementioned researchers is compelling evidence, any errors in the derivation of these original 35 variables would render irrelevant all findings in the subsequent research. Evidence supporting the FFM is thus further enhanced through the work of researchers who did not use Cattell's 35 variables when testing the model. Some of these researchers analyzed instruments not originally intended to measure the FFM. Costa and McCrae (1988) examined the Personality Research Form (PRF; Jackson, 1984), a questionnaire designed to measure Murray's needs, to determine if a relationship exists between the PRF and the FFM. The results indicated that the factor structure of the PRF converges with the FFM. Piedmont, McCrae, and Costa (1991) found that the five factors could be extracted using Adjective Check List (ACL; Gough and Heilburn, 1983). The ACL was originally designed to measure Murray's needs (McCrae & Costa, 1991). Finally, McCrae and Costa (1989) evaluated the Myers-Briggs Type Indicator (MBTI; Myers & McCauley, 1985) with respect to the FFM. The MBTI was originally designed to measure Jungian theories of thinking, feeling, and judging (McCrae & Costa, 1989). They found that the four MBTI indices are correlated with the measures of personality described by the FFM. Moreover, unscored MBTI items tap the neuroticism dimension of the FFM.

Peabody (1987) examined the FFM using a new instrument. His instrument used 57 pairs of traits. He achieved greater representation by combining traits from three existing instruments. Although he found six factors, his results were similar to the FFM.

The first three factors represent seventy percent of the total variance, and as the factors get smaller they are less orthogonal. The sixth factor Peabody found had four of its five largest loadings on the emotional stability factor. Any differences in the FFM and Peabody's findings can be attributed to the representativeness of the scales. Peabody used his own method to define the pool of trait adjectives, one he believes is more representative. Peabody and Goldberg (1989) analyzed seven different data sets. In five of the sets, participants made external judgments (rating others), and in the other two sets they used internal judgments. The authors found that when participants used internal judgments (rated themselves) more variance was accounted for in the factor structure than when they used external judgments (rated others). They found evidence for five factors, with the largest amount of variance concentrated in the first three. These findings were consistent with other researchers' findings. Using a trait list of 1,431 adjectives grouped into 75 clusters, Goldberg (1990) identified the five factors using a variety of factor analytic procedures. He also used peer-nomination and self-report ratings with a representative set of 479 common terms, and identified the five factors across samples. The results of both studies provide support for the generalizability of the FFM across samples and procedures.

Cross Cultural Evidence for the FFM

The FFM can be generalized across cultures. Using a nonverbal measure of personality, Paunonen, Jackson, Trzebinski, and Fosterling (1992) established support for the Big 5 factor structure across four different cultures. These findings imply that the basic human personality is the same across cultures, and that the definition of personality is not dependent upon language. Stumpf (1993) found support for the FFM across 18

different samples, and provided evidence for the generalizability of the PRF. His study included participants from English, French, Dutch, Finnish, German, and Phillipine backgrounds. Different forms of the PRF were used, and were translated to match the participants' backgrounds. An impressive illustration of this transferability was found in the work of Ostendorf (1990, cited in Goldberg & Saucier, 1995). He applied Allport and Odbert's dictionary technique to a German sample using a German language dictionary using the previously described procedure as a basis for generating a questionnaire with trait-descriptive terms. The first five factors he isolated matched those reported in studies using English trait-adjectives. Thus, both English and non-English speaking cultures provide support for the FFM of personality.

Potential Moderator Variables of the FFM

Factor analysis is the analytic technique used to determine the number of factors within a data set. Factor analysis is based upon the correlational model and functions by examining patterns among correlations. A correlation reflects the average relationship between a pair of variables. For some of the cases, scores on the criterion variable can be predicted from the predictor score with very good accuracy. For other cases, predictive accuracy is poor. The correlation between these two variables could be affected by a moderator variable, which is a third variable that changes the nature of the relationship between the first two variables. In short, a moderator variable identifies who can and cannot be predicted accurately. If a moderator variable is present, the number of factors associated with normal personality could be moderated by individual difference variables. Examinations of a hypothesized factor structure as moderated by some

characteristic of the sample have been done in other areas, such as performance appraisal (Facteau & Craig, 2001).

Given that descriptions of personality are filtered through a rater's memory, individual difference variables related to the storage and recall process could serve as moderators of the number of factors. One variable that appears to be relevant is NFC. NFC has been defined as the tendency for individuals to engage in effortful thought (Sadowski & Cogburn, 1997). NFC is an individual difference in human personality because all people do not process or choose to process information in the same way. According to Cacioppo and Petty (1982), individuals who are high in NFC are able to concentrate on, evaluate, and entertain relevant ideas while disregarding irrelevant, extraneous information. This finding is relevant to the present study because individuals who are high in NFC may store and recall more specific information about the individual being rated. Support for this relationship is offered by Lassiter, Briggs, and Slaw (1991) who found that individuals high in NFC exhibited better recall of specific behaviors when rating a target person's behavior than individuals low in NFC. The authors stated this difference between individuals who are high and low NFC occurs because those high in NFC display increased explanatory thinking.

Need for Cognition and the FFM

Sadowski and Cogburn (1997) offered the only study involving NFC and the FFM. In their study, they administered the NFC scale (Cacioppo & Petty, 1982) and the NEO-FFI (Costa & McCrae, 1992) to a sample of undergraduates to investigate the relationship between the construct of NFC and each of the five factors in the five factor structure. They found positive relations between NFC and openness to experience (r =

.50), and NFC and conscientiousness (r = .40) and a negative relation between NFC and neuroticism (r = -.36).The relationship between NFC and openness to experience is explained through the observation that individuals high in NFC are intellectually motivated, curious, and tolerant of different ideas. The relationship between NFC and conscientiousness is consistent with the idea that individuals high in NFC are willing to engage in effortful thinking.

Working Memory and the FFM

The FFM, as stated above, has typically been measured using a peer-nomination strategy, in which participants rate a target individual. This process of rating using bipolar trait scales might also tap the construct of intelligence - specifically, working memory. In order for these individuals to make their ratings, they must think about the target individual's characteristics, thus requiring them to keep several pieces of information in their working (or short-term) memory at once. Miller (1956) proposed the 7+/- 2 rule, which appears to be relevant. This rule states that individuals can keep seven bits of information in their short-term memory at once, plus or minus two bits. This information can be in single units (such as seven numbers) or chunked units (such as seven different lists of people). The fact that there is variation in the amount of information that an individual can entertain in his short term memory at once suggests an individual difference that might limit the amount of information related to the behavior of others. In short, this study addresses the question of whether the FFM represents the true structure of personality or is simply a function of individual differences in memory.

The Present Study

To summarize, FFM research has consistently found five factors. The findings are independent of the specific type of instrument (John, 1990), item generation procedure (McCrae & Costa, 1987), and languages and cultures of the participants (Paunonen et al., 1992). The present study investigates whether NFC moderates the number of factors of normal personality. In short, the "fiveness" of the FFM may simply be a function of individual differences in NFC, and may not reflect the true structure of normal personality.

Hypothesis 1: The factor structure of normal personality will vary as a function of test-taker NFC; that is, the factor structure will be more complex (i.e., more factors) for those with higher levels of NFC.

Additionally, data will be collected to explore the relationship between working memory and the factor structure of normal personality.

Method

Participants

The participants in this study were 630 undergraduate students at a large southeastern university. Each participant completed an instrument measuring the FFM and NFC. Additionally, 293 of the 630 participants completed a measure of working memory.

Instruments

In order to measure normal personality, participants completed Cattell's (1947) list of 35 bipolar traits. The *a priori* item-factor linkages for our analyses were taken from Tupes and Christal's (1961) series of factor analyses of Cattell's instrument. To assess the level of NFC, participants completed the 18 item Need For Cognition scale (Cacioppo & Petty, 1982). Working memory was assessed with the Wechsler Adult Intelligence Scale digit-span exercise (WAIS DS, Wechsler, 1997).

Procedure

Participants completed the instruments during a class period. The instruments were counterbalanced with different groups of participants completing the instruments in different sequences. All responses to Cattell's instrument and the NFC scale were entered on a Scantron form and electronically entered into a computer file. WAIS DS scores were hand entered into the data file. Because memory effects might be enhanced when a person rates the personality of others, as opposed to self-ratings, we instructed participants to describe someone close to them when completing the personality questionnaire. Naturally, participants self-rated when completing the NFC scale and

WAIS DS exercise. A copy of the instructions read to the participants can be found in Appendix A.

Analyses

As indicated previously, two confirmatory factor analyses were performed, one for the dataset containing NFC scores and a second for the dataset containing DS scores (actually a subset of the NFC dataset). High and low scoring subgroups for each analysis were formed by dichotomizing NFC and DS scores at the median. In order for factor analyses by subgroups to retain meaning within each subgroup (as opposed to a factor analysis across all subjects), the five scale scores must not correlate with scores on the variables used to form the groups, NFC and DS. As such, we computed correlations between each of the five factor scales with NFC and DS. The correlations between the *a priori* personality dimensions and NFC and DS are listed in Table 1. As can be seen, none of the correlations were greater than .10, indicating that it was safe to proceed with the planned analyses.

Table 1

Correlations between Five Factor Model Scale Scores and Subgroup Determining Variables (NFC and DS)

Factor	NFC	DS
Neuroticism	.05	-.05
Extraversion	-.02	-.03
Openness to Experience	.06	-.00
Agreeableness	.01	.07
Conscientiousness	-.04	.03

Note. $p > .05$ (two-tailed) for all correlations.

Unfortunately, the planned analyses across all 35 items of Cattell's (1947) personality inventory yielded inadmissible covariance matrices (specifically, the covariance structure was not positive definite) for both the analyses by NFC and DS. As a result, all analyses had to be performed at the individual scale level. Thus, instead of two multigroup confirmatory factor analyses (one for NFC and one for DS), we performed 10 multigroup confirmatory factor analyses (five for NFC and five for DS). Finally, one of the assumptions of maximum likelihood confirmatory factor analysis is multivariate normality. Computation of Mardia's multivariate kurtosis revealed that all but the openness scale in both datasets displayed significant multivariate kurtosis, a violation of the assumption. Table 2 lists the results of the multivariate normality analyses. The consequence of violating the multivariate normality assumption is that maximum

likelihood fit indices are no longer accurate indices of model fit. As a result, all confirmatory factor analyses were performed using unweighted least squares estimation, which has no assumption of multivariate normality. Unfortunately, fewer fit statistics are available when using unweighted least squares estimation.

Table 2

Mardia's Normalized Multivariate Kurtosis Analysis

Scale	Coefficient	Z-value	Coefficient	Z-value
	NFC Sample		DS Sample	
Neuroticism	50.57	3.29*	51.87	3.39*
Extraversion	109.78	9.61*	109.88	6.62*
Openness	36.29	1.94	36.47	1.50
Agreeableness	130.98	8.90*	128.58	4.74*
Conscientiousness	38.79	5.68*	39.88	4.99*

Note. * $p < .05$.

Results

Sample sizes, comparison groups, and fit indices are displayed in Table 3. As can be seen in the table, the analysis of the openness scale as split by digit span resulted in an inadmissible solution and could not be interpreted. For the other nine analyses, all had GFI and AGFIs greater than the traditional .90 minimum cutoff indicative of good fit (Marsh & Hau, 1996) and all but two of the AGFIs had values greater than the more stringent .95 standard. Finally, all RMSR coefficients are less than the .10 level typically seen as indicative of good fit.

Table 3

Fit Indices for Multigroup Confirmatory Factor Analysis

Scale	Items	df	GFI	AGFI	RMSR
Subgroups Formed by Digit Span Scores					
Neuroticism	6	18	.992	.981	.055
Extraversion	9	54	.984	.973	.069
Openness to Experience *	5	-	-	-	-
Agreeableness	10	70	.965	.945	.098
Conscientiousness	5	10	.992	.976	.056
Subgroups Formed by Need for Cognition Scores					
Neuroticism	6	18	.990	.976	.062
Extraversion	9	54	.984	.974	.069
Openness to Experience	5	10	.989	.949	.074
Agreeableness	10	70	.975	.961	.090
Conscientiousness	5	10	.997	.990	.039

Note. Total sample size for Digit Span analyses = 293 (129 with scores above median, 164 with scores below median). Total sample size for Need for Cognition analyses = 630 (293 with scores above median, 337 with scores below median). * Analysis resulted in an inadmissible solution due to a negative variance coefficient for one of the error variance terms. GFI = Goodness of Fit index. AGFI = Adjusted Goodness of Fit index. RMSR = Root Mean Square Residual index.

Discussion

None of the scales of the FFM model correlated with either DS or NFC. This finding was a little surprising given that Sadowski and Cogburn (1997) reported rather substantial correlations between NFC and three of the scales of the FFM. Perhaps the discrepancy can be best explained by the fact that participants in our study self-rated on NFC and WAIS DS but rated others on the personality scale.

Based upon the fit indices, we conclude that the five single factor models fit both subgroups of each hypothesized moderator equally well; that is, the factor structure of the individual FFM scales did not appear to be a function of the test taker's working memory or NFC. Our method of other rating to enhance any memory effects arguably increases the likelihood of finding different factor structures between samples. As such, it is all the more surprising that the *a priori* model fit equally well for both subgroups.

It is unfortunate that the ugly realities of our data did not allow us to proceed with the analyses in the planned format. Clearly, there is a difference between a multigroup confirmatory factor analysis of all five scales simultaneously and five separate multigroup confirmatory factor analyses of the five scales individually. At the very least, the latter does not take into consideration relations among items from different scales. As such, our conclusions must be considered tentative. All that can be done on an overall level is an exploratory factor analysis, which merely describes the data structure and does not allow for hypothesis testing. For purely descriptive purposes, we performed exploratory factor analyses separately by subgroup and upon examination of the scree plot found the same number of factors for high and low scoring subgroups on both NFC

and DS. Curiously, we found that the scree test suggested a four factor structure (in which the conscientiousness and openness items combined to form one factor) as being the best fitting model in all cases.

Suggestions for future research include collecting enough data to adequately test the working memory hypothesis, operationalized in this study as WAIS DS. In addition, different instruments to measure NFC and the FFM of personality can be utilized. Working memory and NFC are not the only variables that might function as moderators; self-awareness has also been suggested. Future research should explore other moderator variables.

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Appendix A

Introduction

Hi, my name is _____, and this is _____.

We're working with a graduate student in Psychology here at Western. She is doing research on her thesis, and asks for your participation in her study. This study consists of three parts. One part asks you to describe the personality of a close friend. Another part relates to thinking styles. The final part is a measure of short term memory.

Participation in this study is entirely voluntary. You can drop out now (before we begin) or at any point during the study if you wish.
HAND OUT THE INFORMED CONSENT FORM. ASK IF THERE ARE ANY QUESTIONS.

Script: Personality Test

(PASS OUT PACKET A. AFTER ALL PACKETS HAVE BEEN DISTRIBUTED, BEGIN INSTRUCTIONS)
In this part of the study, you're going to be making ratings between two traits. If you'll open to the first page, you should see example 1. Does everyone have an example 1? Good.

This is a sample item. All the items on this part of the study will look like this. Now, this is the important part. When you are evaluating these two traits, I don't want you to think of yourself. I want you to think of someone close to you, such as a sibling or a good friend. This should be someone who you could describe in detail if you were asked questions about his or her personality. Please write your relation to the person in the space provided.

Does everyone understand? Are there any questions?
OK, good.

Now, look at the two traits in sample 1, and look at the scale between them. The scale matches the bubbles on the scantron. When thinking about this person you've decided to rate, darken the bubble on the scantron that matches your choice. Please do not write on the pages in the packets. We want to use these with other volunteers.

Any questions?

Script: Need for Cognition Scale

(PASS OUT PACKET B. AFTER ALL PACKETS HAVE BEEN DISTRIBUTED, BEGIN INSTRUCTIONS)
In this part of the study, you'll be answering questions regarding how much you like to think. In this part of the study, you need to think about yourself. When you answer these questions, don't think about how anyone else would answer the questions, only how you would answer them.

Ok, open to the first page, and you should see sample 1. Does everyone have a sample 1? Good.

Everyone read the question, and notice that the scale matches the bubbles on the scantron. Mark your answer to the question on the scantron, and be careful not to write on the pages in the packet. We want to use this again for other volunteers.

Any questions?

Script: WAIS

(THIS INSTRUMENT IS ADMINISTERED ONE ON ONE.)
Part 1

Sit in front of the participant and keep your materials hidden so they can't see what's in front of you. This is so they can't read the lists of numbers and rehearse them before they're asked.

REFER TO DIRECTIONS ON WAIS INSTRUMENT

Any questions? Ok, let's begin

Read the first list of numbers. MAKE SURE TO LEAVE A ONE-SECOND DELAY BETWEEN NUMBERS. READ THE ENTIRE LIST BEFORE ALLOWING THE PARTICIPANT TO REPEAT IT.

After the participant has missed two in a row, move to the next part of the test

Part 2

(IN THIS PART, LISTS ARE READ AND PARTICIPANTS MUST REPEAT THEM IN REVERSE OF THE WAY THEY WERE READ.
FOR EXAMPLE, THE LIST 12345 *WOULD BE REPEATED* 54321 *TO BE CORRECT)*

The lists are read in the same fashion (one-second delay between numbers) as the lists in part 1. And when the participant has missed two in a row, the test is over.

REFER TO DIRECTIONS ON WAIS INSTRUMENT

Any questions? Let's begin

WHEN YOU ARE FINISHED, THANK THE PARTICIPANT AND DISMISS HIM/HER.